



NEW ZEALAND JOURNAL OF ARCHAEOLOGY



This document is made available by The New Zealand Archaeological Association under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

To view a copy of this license, visit
<http://creativecommons.org/licenses/by-nc-sa/4.0/>.

Model Gardens and the Acceptability of New Crops to Polynesian Horticulturalists

Helen Leach

Anthropology Department, University of Otago

ABSTRACT

European food plant introductions in Polynesia were sometimes made through specially prepared gardens designed to serve as models. Although these were set up on many islands in the late eighteenth and early nineteenth centuries, they were largely unsuccessful in demonstrating European cultivation techniques. The Polynesians may have resisted European horticulture, but they readily accepted those plants which they could classify within their traditional gardening and cooking systems. It is possible that the sweet potato was just as readily accepted 1500 years earlier by being classified as a type of yam.

Keywords: POLYNESIA, GARDEN, EUROPEAN PLANTS, INTRODUCTIONS, SWEET POTATO.

INTRODUCTION

This paper examines the processes by which certain European plants became part of the Polynesian set of cultigens, though others were resisted or rejected. The subject interests me as a prehistorian because at least some of the reasons for accepting or rejecting a food plant in the eighteenth and nineteenth centuries must have applied at earlier times. The first section deals with the various ways Europeans presented their plants for introduction, and the second looks at the acceptability of particular plants and the reasons behind this.

In the context of Pacific history the setting up of model gardens was one of the most emphatic demonstrations by European explorers and missionaries that they wished plant introductions to succeed. Their motives appear to have ranged from simultaneously marking formal possession of an island group (which was the intention of the Spanish when they sowed maize in the Marquesas in 1595 (Thomson 1980:3, Parsonson 1979:116)) to improving the resources of the islands (though not exclusively for the indigenous inhabitants—some had future European visitors or settlers in mind) (e.g. Ellis 1969:49). Missionaries often turned their own gardens into models for instructing the natives in the horticulture of European plants, and they sometimes supplied Christian converts, such as David Taiwanga of the Bay of Islands in New Zealand, with planting material and tools to act as a more powerful exemplar (Davis ms.). The late eighteenth century explorers such as Cook (Beaglehole 1967:158), Bougainville (1772:229), and Bligh (1792:76) had begun this practice by planting new items in or close to the gardens of sympathetic chiefs (like Ereti and Poeno on Tahiti), hoping that this would afford them greater protection than those planted at locations chosen simply because they were close to the anchorages. Thus the term "model gardens" covers a range of planting contexts from those cleared, sown, and then abandoned by the departing Europeans (such as Cook's various gardens at Queen Charlotte Sound), to those set up and maintained by resident Europeans motivated to encourage the cultivation of new plants of economic potential. The question must now be asked: did model gardens influence the outcome of these introductions?

MODEL GARDENS AND INTRODUCTIONS IN NEW ZEALAND

A surprisingly large number of plant introductions can be documented for New Zealand between 1769 and 1800. The French explorer de Surville gave wheat, peas, and ears of rice to a chief at Doubtless Bay in 1769, trying to explain by signs how to sow the wheat, "harvest it, crush it to make flour of it, turn this flour into a paste, and cook it to get bread" (McNab 1914:343). There is no evidence that he actually had ground prepared, nor that his pantomime of gestures had any chance of success among root-crop producers. In the same year Cook gave two handfuls of potatoes to a chief at Mercury Bay (Thomson 1859:158, Begg and Begg 1969:35-6). He probably realised that their chances of survival depended on the interest of the chief and that horticultural instructions were not needed. Maori recollection of this event indicated that these potatoes had been planted for three consecutive years to build up the supply and were then distributed. This may have been the first successful introduction of a European food plant to New Zealand. Within two years of this event Marion du Fresne established the first model garden in New Zealand, on Moturua Island in the Bay of Islands, planting wheat, maize, potatoes, and various kinds of nuts, all of which grew well initially, although it was winter (McNab 1914:399). With the help of Tahitian vocabularies, the French had tried to explain how useful these plants might be. Although the Bay of Islands was going through a turbulent phase, the fact that the potatoes were actually growing may have increased their chances of survival. The other plants appear to have failed.

James Cook's New Zealand gardens were designed to introduce new useful plants of benefit to later voyagers and indigenous inhabitants alike. These gardens were made during the second voyage at five locations in Queen Charlotte Sound (McNab 1914:197, 207; Barratt 1979:83; Begg and Begg 1969:117, 122; Burney 1975: 50, 54-5; Beaglehole 1967:62; Beaglehole 1969:287) and one in Dusky Sound (Begg and Begg 1969:110-111; McNab 1914:491). The Queen Charlotte Sound gardens were planted in autumn 1773 with potatoes from the Cape of Good Hope (introduced to the local Maori as "coumalla"), carrots, and parsnips (called "tara"), cabbages, onions, leeks, parsley, radish, mustard, broad beans, kidney beans, peas, and turnips. A separate piece of ground was planted with wheat. At the end of winter the radishes and turnips were found to have run to seed, the cabbages, carrots, onions, and parsley were in good condition, and some of the peas and beans were thought to have been eaten by rats. Most significantly it appeared that the potatoes had been dug up and removed. By the time of the third voyage in 1777, the hardier vegetables (such as cabbage, onion, leek, and mustard) which had self-sown, marked the sites of the former gardens. Only a few potatoes were seen. There is a good possibility that those dug up and removed in the winter of 1773 were the source of the potatoes which were being grown in quantity along the shores of Foveaux Strait by 1810 and Otago Harbour by 1813. Early records show that these were being grown according to traditional kumara methods—the plants were set in little mounds made with the *ko*, they were tapu while half-grown, and their harvest was accompanied by first fruit ceremonies (Davies 1980:117; Begg and Begg 1979:221; Sydney Gazette 25/8/1810). This suggests that they had been introduced to the south by experienced gardeners, probably the Ngai Tahu of the Kaikoura Coast who had close ties with Otago and Southland and who were known to raise kumara.

A variation on the model garden approach came late in the eighteenth century, when the two Northland Maoris kidnapped to reveal the secrets of flax working were brought back from Norfolk Island. There they had personally observed European gardening and farming operations, and they were sent home with maize, wheat, peas, and various garden seeds by Governor King in 1793 (McNab 1908:185,

Nicholas 1817 (II):366). This maize introduction, rather than Marion du Fresne's, was the more likely source of the maize seen growing in Bay of Islands' Maori gardens in 1815 (Nicholas 1817 (I):341, 351). This crop was not mentioned by Savage (1807) who called in there in 1806, and it may still have been confined to the Doubtless Bay area where the two Maoris were landed. In contrast to the maize, which seems to have spread slowly, turnips and potatoes were widely disseminated by 1800 (Best 1980:68). Overall there is no substantial evidence that the eighteenth century model gardens passed on European gardening techniques to the Maori people. In terms of introductions, they appear to have been the source of only the South Island potato, the wild cabbage and the turnip. The North Island potato and maize seem to derive from European gifts to influential Maoris, in no way associated with the making of any model gardens.

INTRODUCTIONS IN TROPICAL POLYNESIA

Were the model gardens of tropical Polynesia any more successful? The literature for the Society Islands reveals many introductions and several model gardens, and the group was visited sufficiently frequently for the success or otherwise of the introductions to be gauged. Beaglehole records that men of the *Dolphin*, the first European ship to encounter Tahiti in 1767, planted "peach, plum and cherry stones and garden seeds, limes, lemons and oranges" (Beaglehole 1955:xcv). The Captain, Wallis, also made a gift of livestock, various unnamed garden seeds, peas, and some small white kidney beans to a high-ranking woman (Robertson 1973:114). Although the animals were commented on less than a year later by the next visitors under the command of Bougainville, there is no mention of any of these stones or seeds growing successfully. In their turn, the French made new introductions, this time to the chief Ereti. Bougainville wrote:

I likewise desired him to make a garden in our way, and to sow various sorts of seeds in them, and this proposal was received with joy. In a short time, Ereti prepared a piece of ground, which had been chosen by our gardeners, and got it inclosed. I ordered it to be dug; they admired our gardening instruments . . . We sowed for their use some wheat, barley, oats, rice, maize, onions, and potherbs of all kinds. We have reason to believe that these plantations will be taken care of. (Bougainville 1772:229)

There is no evidence that they were.

The following year Cook spent several weeks in Tahiti accompanied by several of the men who had been on the *Dolphin*. On May 10, 1769, Cook arranged for a garden to be planted. Banks was later to comment that Cook's seed "prov'd so bad that no one has come up except mustard, even the Cucumbers and melons have faild, owing probably to the method of their being packd which was in small bottles seal'd down with rosin" (Beaglehole 1962:308-9). Banks himself had more success: on July 4 he planted "a large quantity of the seeds of Water melons, Oranges, Lemons, limes &c" which he had brought from Rio de Janeiro (Beaglehole 1962). He had already given large amounts of water melon seed away, as well as planting some in the woods. Significantly he commented: "they now continually ask me for seeds and have already shew'd me melon plants of their raising which look perfectly well" (Beaglehole 1962).

The western coast of South America was the source of the Spaniard Boenechea's planting material brought to the Society Islands in 1772. It included wheat, maize, pumpkins, melons, water melons, sweet potatoes, *Solanum* potatoes, garlic, onions, various beans, chick peas, and the pawpaw (also called papaya) (Corney 1913 (I):296, 309). Cook was of the opinion when he returned in 1773 that, of all the seeds previously introduced, only the pumpkin had succeeded (Beaglehole 1969:232). I suspect that he based his observations on a restricted area. The new sweet potatoes

would not have had time to become widely propagated, nor would the papaya have reached fruiting stage.

The Spanish continued to bring in plants and seeds from Peru between 1774 and 1776 when their mission was abandoned. In addition to those mentioned earlier, they tried to grow parsley, purslane, lettuce, endive, broccoli, cabbage, turnip, tobacco, tomatoes, capsicum peppers, cherimoyas (custard apples), grapes, and rice. The missionaries noted that the Tahitians themselves were trying to grow maize. Like the Spanish mission, most of these plantings failed from a combination of bad seed, planting at the wrong season, flooding, rats, and pigs (Corney 1913 (III):60-146). However, some of their grape vines survived a few years, for Omai took cuttings from the vines after they were trampled in 1777 (Beaglehole 1967:195). Capsicums and pumpkins were traded to Bligh a decade later (Bligh 1792:64), and tobacco was seen growing wild (Bligh 1792:68). All of these should probably be ascribed to Spanish introduction.

By the time of Cook's third visit the difficulties of establishing temperate zone vegetables and fruits were fully appreciated. On this occasion Cook's gardener Nelson planted Tongan shaddocks on both Tahiti and Huahine, together with melons, potatoes, and pineapples (Beaglehole 1967:195, 235, 237, 242). One of the shaddocks survived to be recorded in 1824 (Ellis 1969:370-2). Nelson accompanied Bligh in 1788 and they sowed various seeds from the Cape of Good Hope, besides distributing fruit stones, almonds, and rose hips (Bligh 1792:86). Once again, several model gardens were made and planted with such things as melon and cucumber seeds (later destroyed by insects) and salad seeds. They encountered "trampling", a type of destruction which they and later missionaries did not realise was quite a common fate for European gardens in Polynesia. The first record for Tahiti was the trampling of the Spanish grape vines about 1777. Then Omai's garden suffered from pilfering and later destruction after his death. The second episode involving Europeans was noted by Bligh in 1788:

I had the mortification to see that our garden-ground had been much trod over; and, what was worse, the chiefs appeared but little concerned at it. To this kind of carelessness and indifference I attribute the miscarriage of many of the plants left here by Captain Cook. (Bligh 1792:86)

He did not realise that this was a very deliberate form of carelessness. Bligh's two flourishing orange plants, vines, fig tree, and pineapple plants he gave to Poeno for protection. The garden set up near Poeno's house was also planted with other items, including maize. Another garden set up near Cook's original camp in Matavai Bay had suffered pig damage, but Bligh notes that "some underground pease [peanuts?] and Indian corn had escaped, and likewise the caliloo green [*Xanthosoma* sp.] and oca of Jamaica" (Bligh 1792:121). The caliloo green was soon preferred to taro leaves as a green vegetable (Barrau 1962:296, Maclet and Barrau 1959:12). Again we see how the Europeans were tailoring their introductions to suit the tropical conditions by transferring plants from the West Indies. Of course, this was a two-way trade since Bligh's prime purpose in visiting Tahiti was to take breadfruit trees back to the Caribbean (Ellis 1969:2).

The second group of missionaries to arrive in Tahiti were those from the London Missionary Society, who tried at the same time to establish themselves in Tonga and the Marquesas. When they arrived on the *Duff* in 1797, they brought with them seeds from Europe and Brazil. All their later contacts were through New South Wales, which was a clearing house for plant material from many parts of the world. In 1801 they received from there plants of the vine, fig, and peach which thrived well until they were destroyed. Ellis (1969:49) wrote "in the war which broke out shortly after, the fences were broken down, the plants torn up or trodden under foot, and

the garden was entirely destroyed." Once again this deliberate vandalism was misread by the Europeans as an accident of war; however, Ellis's next comment suggests that he, at least, suspected otherwise. He wrote: "Pineapples and water melons, of which the natives seemed remarkably fond, were preserved amidst the general devastation" (Ellis 1969). When Ellis reported the destruction by fire of a missionary plantation of over 600 coconuts, oranges, limes, and citrons about 1805, he suggested that the fire had been deliberately allowed out of control lest future harvests gave the missionaries long-term rights to the land (Ellis 1969:71). Although a non-owner might be granted permission to use vacant ground for a season by the owner, in Polynesian land tenure systems it was regarded as an infringement of the owner's rights if the "tenant" planted tree crops. Other European gardens were simply dismantled and the valuable plants moved to native gardens (Ellis 1969:247). Thus by 1824, a typical native Tahitian house garden described by Ellis (1969:372) contained a mixture of traditional plants and European introductions: there were plantains and other types of bananas, clusters of sugar cane, papaya trees, and rows of pineapples. Almost certainly other gardens of that period would have contained, in addition to the *Colocasia* taro, the *Xanthosoma* types, some recently introduced sweet potatoes, capsicums, water melons, small amounts of maize, and possibly the Cape gooseberry, guava, rose-apple, custard-apple, and some citrus.

Most of the other Polynesian groups, though less frequently visited than the Societies, also had model gardens made on them during the eighteenth and early nineteenth centuries, and a set of plant introductions from similar sources. For example, in the Tongan islands Cook left an assortment of seeds on his second voyage in 1773 (Beaglehole 1969:262) and ate turnips grown from the progeny of this seed on his third voyage (Beaglehole 1967:158). On this latter visit they sowed corn, melons, and pumpkins and planted pineapples on Lifuka (Beaglehole 1967:120). The ants ate most of these, but the pineapple flourished as it did on Tahiti. On Eua, Cook planted a pineapple and sowed melon seeds within the protection of a chief's enclosed garden (Beaglehole 1967:158). The ultimate survival of most of these introductions is uncertain because of the warfare which engulfed the Tongan islands in the early nineteenth century. Certainly only the pineapple figured in the Tongan vocabulary published by Martin (1817). Nevertheless, it should be remembered that even if they had survived only a few years, this would still have provided opportunities for their transfer by Polynesians to other islands. Similarly, the fate of eighteenth century introductions to the Marquesas is uncertain. None were mentioned in Robarts' memoirs of the period 1797-1824 (Denig 1974). Yet by 1841, the papaya, pineapple, tobacco, and capsicum appear in a list of principal plants; at the same time English missionaries are credited with the introduction of coffee, indigo, dates, oranges, lemons, limes, two kinds of custard apple, walnuts, Brazilian plums, pumpkins, water melons, musk melons, and various English vegetables (Thomson 1980:15). The history of introductions to the Hawaiian islands is rather better documented through the journals of Don Francisco de Paula Marin. His was probably the initial introduction into Polynesia of the avocado (before 1825), mango (1824), and tamarind (1797) (Gast and Conrad 1973).

WHY WERE SOME SPECIES ACCEPTED?

Documenting the history of plant introductions into Polynesia has barely begun. But from the material gathered so far it is readily apparent that lists of "highly acceptable" plants can be drawn up for the tropical islands and for temperate New Zealand. While these lists are based on the historical records, explanation of why certain plants were more acceptable than others must be based on clues within the

vernacular names and in the accounts of the growing and processing of the plants by the Polynesians. (The chief sources of plant names are Barrau (1959, 1960, 1961, 1962), Jardin (1974), Maclet and Barrau (1959), Massal and Barrau (1956), Papy (1955), Rollin (1929), Seemann (1862), Walsh and Biggs (1966), Wilder (1931), together with general dictionaries and vocabulary lists published for individual island groups.) One problem with this approach is to allow for the different times at which introductions were made. A list of highly acceptable plants at the beginning of the 1840s would not include manioc, nor the dwarf Chinese banana, both of which became important additions to Polynesian diet by 1860. Despite these difficulties, the generalization may be made that in the first century of regular European contact certain introduced plants were particularly acceptable to the Polynesians of the tropics: 1) *Xanthosoma* varieties of taro; 2) cassava or manioc; 3) the dwarf banana; 4) various cucurbits such as water melons, melons, squash, and pumpkins; 5) papaw or papaya, and 6) pineapple. Slightly less important but still quite rapidly accepted were 7) capsicums; 8) maize; 9) new types of sweet potato; 10) guavas; 11) Cape gooseberries; 12) citrus fruits (especially in West Polynesia); 13) custard apples and other species of *Annona*, and 14) mangoes.

Despite repeated introductions, peas, beans, and other pulses remained insignificant in Polynesian diet; similarly, peanuts, salad greens, radishes, carrots, cucumbers, and onions, although often well-suited to the conditions, never achieved the popularity of the introduced tropical fruits. Rice was also subject to multiple introductions. Although now a staple food in many parts of Eastern Polynesia, it is as an import from Southeast Asia, not a local production. Thus it was acceptable as a food but not as a plant to be cultivated, harvested, and processed.

Acceptability depended on the willingness of the gardener to fit a new crop into his various plots and of the cook to fit a new food into the menu. The gardener needed to know how to propagate the plant, what spacing it required, its moisture needs, and when it was ready to harvest. The cook had to know which parts were edible and when, how to process them, and for how long. Since the model gardens seldom reached maturity, the information which Europeans possessed about the horticulture of the new plants was only imperfectly passed on. European processing techniques were for a long time quite irrelevant, since they required many unobtainable tools and utensils. The Polynesians had no other choice than to classify the new plants as akin to an existing cultigen and apply the relevant cultivation and culinary techniques. On the success of this depended the survival of the introduction.

With the *Xanthosoma* taro varieties there was no problem of acceptance whatsoever—they were more convenient to grow and possessed less acrid leaves. In most of Polynesia and Fiji, cassava was classified as a starchy root allied to the Polynesian arrowroot. The starch was extracted from it by washing the grated flesh in identical manner to the arrowroot; hence it took the same name *pia*. Only in a few places such as Manu'a was it classified in another way, as a type of yam. The dwarf banana brought from China via England posed no more problem of classification than the *Xanthosoma* taro. Its vernacular names tend to reflect the source of the introduction e.g. *fa'i papalangi* in Samoa and *hamoa* or *samoa* in other parts of Polynesia. The cucurbits seem to have been classified as types of gourd (*hue*) or Pacific melon (*timo* or *katiu*); although their modern names are Polynesian versions of melon or pumpkin (i.e. *mautini*, *meleni*, *mereni*), one form was called *hue akau* (woody gourd) in the Marquesas. The papaya was apparently classified as a *vi* apple (*Spondias dulcis*), although this is reflected in only one of its Marquesan and one of its Fijian names. Elsewhere it appears as *ninita* and variants of that term in East

Polynesia (but not Hawaii) and *oleti* or *weleti* in Fiji and West Polynesia. To me this gives the impression that after the original Spanish introductions, the distribution of the pawpaw was undertaken from two centres, one western, one eastern, largely by indigenous contacts. Certainly some Polynesians had the plant for long enough to believe it to be indigenous, e.g. on the Marquesas where one of its names was *vi enana*, i.e. the *vi* belonging to Marquesan man.

The pineapple was another early introduction. In most parts of Polynesia and in Fiji it took the term for the edible pandanus, i.e. *fara*, *hara*, *hala*, *ara*, *vadra*, and *balawa*, plus a qualifier. Thus in the Marquesas, where it grew wild, it was *fa'a hoka* or pandanus causing smarting pain (from its spiny leaf edges), and in Hawaii it was *hala kahiki* or foreign pandanus and *hala 'ai* or edible pandanus. The East Polynesian residents of high islands were not in the habit of eating pandanus; so although they knew how the plant grew, processing the pineapple fruit was a matter of experiment. Ellis noted in the 1820s that the Tahitians had been "so mistaken in the nature of the fruit, that they baked numbers of them in their native ovens, before they attempted to eat any undressed" (Ellis 1969:49).

Capsicum peppers were readily classifiable with the indigenous Polynesian solanum varieties, which were known as *poro* and its variants. Thus in parts of Polynesia *'oporo* or *polo* now refer as much to chillies as to the black nightshade. Unfortunately I have no information as to how they were integrated into Polynesian cooking, and I wonder if their use was not initially just medicinal or if they were grown simply for trade. Maize posed greater problems of classification. Horticulturally it was usually regarded as akin to sugar cane (*to*) or bamboo (*kohe*); hence Tahitians called it *to popa'a* or foreign sugar cane, and the Marquesans *kohe o te aoe* or foreign bamboo. Fijians likened it to the wild grass *sila*, *Coix lachryma* or Job's tears. It was the only cereal to be fully accepted in Polynesia but not without repeated introductions. Possibly the need to experiment with cooking methods slowed its adoption. Until cooking pots were freely available, it was usually roasted immature within the husks. Guavas and Cape gooseberries were acceptable for their sweet fruit and ability to self-propagate, while the mango was seen as yet another form of the *vi* apple.

Plant acceptability in New Zealand also depended on the successful classification of the newcomer within traditional frameworks. Of course, some of the plants on the list of highly acceptable introductions differed from those of the tropics, simply because the New Zealand climate was largely temperate, at best sub-tropical in the far north. Forty years after the Maoris' first exposure in Northland to European plants, the five pre-European food plants were still grown but had been joined in Maori gardens by two other root crops, potatoes and turnips, by a green crop, cabbage, and by the tall maize. The most successful introduction of all was the potato, and seven vernacular names for this plant were listed in 1820. The most interesting were the terms *uwahi* and *ngangarangi* (Kendall 1820). The first was the general word for the traditional yam *Dioscorea alata*, the second was a variety of this yam. By 1844 the original yam was nearly forgotten, and in Northland the term *uwahi* meant winter-grown potato (Williams 1844). Turnips were initially named *pakeha* or *keha* for their whiteness, also *tunguru* which means blunted (Kendall 1820). In 1817 it was recorded that turnips were dried and preserved in exactly the same manner as young kumara was processed into the delicacy known as *kao* (Thomson 1859:159, Polack 1838:291). Cabbage was initially called *puka*, possibly from its resemblance to the big leaf clusters of Northland's puka tree (*Meryta sinclairii*) or the fleshy leaf of *Coprosma lucida*. Like the turnip, it was probably welcomed for its large leaves, suitable for wrapping packages of food for the earth

oven. By comparison with the tropics, New Zealand seems to have been deficient in large-leafed plants for this purpose.

The most surprising new plant of the Maori gardens was maize, which was adopted before there were any facilities for grinding the grain or boiling the cobs. However the cobs were amenable to two traditional methods of processing, both of which were used: the first was to roast them in the embers just as the Maoris did lengths of bracken fern root (Nicholas 1817 II:83); the second was to soak the mature dry cobs in a basket in water for several weeks until they became soft. The anaerobically fermented grains were then scraped off the cobs and formed into cakes for roasting in the embers or steaming in the *umu* (Earle 1909:111). This technique was traditionally applied to the processing of certain wild fruits such as hinau.

There is some evidence that, unlike potato growing, early maize production was an uncertain trial and error pursuit and not widespread until the 1820s. In 1814 Nicholas (1817 II:82-3) commented on the unpromising appearance of a plot of about a hundred maize plants in the Bay of Islands. He attributed their poor state to being set only 30-40 cm apart with potatoes between them. Possibly the close planting of maize was in imitation of European cropping of wheat and barley, which were also referred to as "corn". By this time several influential Northland Maoris had travelled to Australia and even England, and their missionary associates were making great efforts to encourage them to grow cereals. On their return they may have passed on instructions to maize-growers which were intended to apply to wheat. In the 1830s Northland maize plants seen by Polack (1840:192) were spaced 60 cm apart while spacings greater than 90 cm were noted near Auckland (Terry 1842:56).

Great resistance was shown to the adoption of wheat, despite numerous introductions. Later the Maoris were to explain that it was too labour intensive and required too much processing (Davis ms. for 1826). Not only was it out of place in their gardens, but until flour mills and cooking pots were widespread it was unacceptable to the Maori cook. In contrast, new types of taro and sweet potato brought to New Zealand about 1820 appear to have spread very rapidly (Leach n.d.). Watermelons were also readily assimilated. This plant was present in Maori gardens of the Bay of Islands by 1821, taking the name *hue* formerly applied only to the gourd (McNab 1908:544, Cruise 1823:163). It was joined during the 1820s by pumpkins of various sorts and the vegetable marrow. The latter was said to have been cured gourd-style for making water bottles (Polack 1838:291). Instead of the pawpaw, the peach was the fruit most rapidly disseminated, since it grew readily from stones discarded along tracks and in village middens. Cape gooseberries also spread quickly since they were as palatable to birds and children in northern New Zealand as they were in tropical Polynesia (Hursthouse 1849:139).

DISCUSSION

Although temperate New Zealand and tropical Polynesia provided rather different settings for plant introductions, the same requirements operated if the introduction was to be successful. Fifteen hundred years earlier, the ability to be fitted in to traditional Polynesian gardening and cooking systems must have provided the sweet potato with a high degree of acceptability. Although vernacular names no longer provide any clue as to how it was classified, in horticultural and culinary operations it appears to have been treated as a yam in several parts of Oceania, i.e. grown on a *puke* or mound, sometimes propagated from tubers, sometimes stored. I wonder whether it may have borne the name *ufi kumara* for the first century or so after its introduction. One of the theories proposed for its transmission to Oceania is that of

a Polynesian canoe reaching the coasts of South America and returning with the kumara. It is interesting to note that by 200 B.C. in coastal Peru, not only was the sweet potato available, but also manioc, maize, guavas, capsicums, musk melons and other squash (Cohen 1977). *Xanthosoma* species and pineapples were probably available further north on the Ecuadorian coast (Towle 1961). Since these cultigens were highly acceptable to Polynesians in the eighteenth and nineteenth centuries, it is hard to explain their failure to have joined the sweet potato in this early introduction. To me this strengthens the argument for an accidental non-human transmission of the sweet potato. But the purpose of this research has not been to contribute yet another opinion on an old and thorny issue. It has been to document the conditions under which successful plant introductions occur, a subject which has seldom been examined by prehistorians, despite their preoccupation with diffusion.

REFERENCES

- Barratt, G. 1979. *Bellingshausen; a Visit to New Zealand: 1820*. Dunmore Press, Palmerston North.
- Barrau, J. 1959. L'Agriculture Polynésienne au contact des étrangers. *Journal de la Soci  t   des Oc  anistes* 15: 147-163.
- Barrau, J. 1960. Plant introduction in the tropical Pacific. *Pacific Viewpoint* 1:1-10.
- Barrau, J. 1961. *Subsistence Agriculture in Polynesia and Micronesia*. Bernice P. Bishop Museum Bulletin 223.
- Barrau, J. 1962. Notes on the significance of some vernacular names of food plants in the South Pacific Islands. *Proceedings of the 9th Pacific Science Congress 4 (Botany)*: 296-8.
- Beaglehole, J. C. (Ed.) 1955. *The Voyage of the Endeavour 1768-1771*. Cambridge University Press for the Hakluyt Society.
- Beaglehole, J. C. (Ed.) 1962. *The Endeavour Journal of Joseph Banks 1768-1771* Vol. 1. The Trustees of the Public Library of New South Wales.
- Beaglehole, J. C. (Ed.) 1967. *The Voyage of the Resolution and Discovery, 1776-1780*. Part One. Cambridge University Press for the Hakluyt Society.
- Beaglehole, J. C. (Ed.) 1969. *The Voyage of the Resolution and Adventure, 1772-1775*. Cambridge University Press for the Hakluyt Society.
- Begg, A. C. and Begg, N. C. 1969. *James Cook and New Zealand*. New Zealand Government Printer, Wellington.
- Begg, A. C. and Begg, N. C. 1979. *The World of John Boulton*. Whitcoulls Ltd, Christchurch.
- Best, S. 1980. Oruarangi Pa: past and present investigations. *New Zealand Journal of Archaeology* 2:65-91.
- Bligh, W. 1792. *A Voyage to the South Sea*. . . (Facsimile edition 1979). Australiana Facsimile Editions, Hutchinson of Australia.
- Bougainville, L. de 1772. *A Voyage Round the World*. . . (trans. J. R. Forster). Printed for J. Nourse and T. Davies, London.
- Burney, J. 1975. *With Captain James Cook in the Antarctic and Pacific . . . 1772-1773*. (Ed. B. Hooper). National Library of Australia, Canberra.
- Cohen, M. N. 1977. Population pressure and the origins of agriculture: an archaeological example from the coast of Peru. In Reed, C. A. (Ed.), *Origins of Agriculture*: 135-177. Mouton, The Hague.

- Corney, B. G. 1913-1919. *The Quest and Occupation of Tahiti by Emissaries of Spain During the Years 1772-1776*. 3 vols. Hakluyt Society, London.
- Cruise, R. A. 1823. *Journal of a Ten Months' Residence in New Zealand*. Longman, Hurst, Rees, Orme, and Brown, London.
- Davies, F. J. 1980. The prehistoric environment of the Dunedin area: the approach of salvage prehistory. Unpublished M.A. Thesis, Anthropology, University of Otago.
- Davis, R. ms. Letters and Journals 1824-1863. Hocken Library, Dunedin.
- Dening, G. 1974. *The Marquesan Journal of Edward Robarts 1797-1824*. Australian National University Press, Canberra.
- Earle, A. 1909. *A Narrative of a Nine Months' Residence in New Zealand in 1827*. Whitcombe and Tombs, Dunedin.
- Ellis, W. 1969. *Polynesian Researches. Society Islands*. Charles E. Tuttle Co., Tokyo (first published 1831).
- Gast, R. H. and Conrad, A. C. (Eds) 1973. *Don Francisco de Paula Marin*. The University Press of Hawaii for the Hawaiian Historical Society, Honolulu.
- Hursthouse, C. 1849. *An Account of the Settlement of New Plymouth . . .* Smith, Elder and Co., London.
- Jardin, C. 1974. *Kulu, Kuru, Uru: Lexicon of names of food plants in the South Pacific*. South Pacific Commission Information Document 35.
- Kendall, T. 1820. *A Grammar and Vocabulary of the Language of New Zealand*. Church Missionary Society, London.
- Leach, H. M. n.d. *A Thousand Years of Gardening in New Zealand*. A. H. and A. W. Reed, Wellington. In press.
- McNab, R. 1908. *Historical Records of New Zealand*. Vol. 1 New Zealand Government Printer, Wellington.
- McNab, R. 1914. *Historical Records of New Zealand*. Vol. 2 New Zealand Government Printer, Wellington.
- Macllet, J-N. and Barrau, J. 1959. Catalogue des plantes utiles aujourd'hui présentes en Polynésie Française. *Journal d'Agriculture Tropicale et de Botanique Appliquée* 6(1-3):1-21.
- Massal, E. and Barrau, J. 1956. *Food Plants of the South Sea Islands*. South Pacific Commission Technical Paper 94.
- Martin, J. 1817. *An Account of the Natives of the Tonga Islands . . .* Vol. 2 John Murray, London.
- Nicholas, J. L. 1817. *Narrative of a Voyage to New Zealand*. 2 vols. James Black and Son, London.
- Papy, H. R. 1955. *Tahiti et les îles voisines: La végétation des îles de la Société et de Makatea*. Part 2. Travaux du Laboratoire Forestier de Toulouse, Toulouse.
- Parsonson, G. S. 1979. Select Documents in the Exploration of the Pacific. Vol. 1. The Voyages of Mendana and Quiros 1568-1610. (Held in Central Library, University of Otago).
- Polack, J. S. 1838. *New Zealand . . . 1831-1837*. 2 vols. Richard Bentley, London.
- Polack, J. S. 1840. *Manners and Customs of the New Zealanders*. Vol. I. James Madden and Co., London (Capper Press Reprint 1976).

- Robertson, G. 1973. *An Account of the Discovery of Tahiti . . .* (Ed. O. Warner) Folio Press, J. M. Dent, London.
- Rollin, L. 1929. *Les Îles Marquises, Géographie, Ethnographie, Histoire, Colonisation et Mise en Valeur*. Société d'Éditions Géographique Maritime et Colonial.
- Savage, J. 1807. *Some Account of New Zealand*. J. Murray, London.
- Seemann, B. 1862. *Viti: An Account of a Government Mission to the Vitian or Fijian Islands in the Years 1860-61*. Macmillan & Co., Cambridge.
- Terry, C. 1842. *New Zealand, its Advantages and Prospects . . .* T. and W. Boone, London.
- Thomson, A. S. 1859. *The Story of New Zealand*. John Murray, London.
- Thomson, R. 1980. *The Marquesas Islands: Their Description and Early History*. (Ed. R. D. Craig) Second edition. The Institute for Polynesian Studies, Laie, Hawaii.
- Towle, M. A. 1961. *The Ethnobotany of Pre-Columbian Peru*. Viking Fund Publications in Anthropology 30.
- Walsh, D. S. and Biggs, B. 1966. *Proto-Polynesian Word List 1*. Te Reo Monograph no. 4. Linguistic Society of New Zealand, Auckland.
- Wilder, G. P. 1931. *Flora of Rarotonga*. B. P. Bishop Museum Bulletin 86.
- Williams, W. 1844. *A Dictionary of the New Zealand Language*. Church Mission Press, Paihia.

Received 6 April 1983